$$-2=\frac{c_1}{a_1\rho\cos\theta+b_1\rho\sin\theta}+\frac{c_2}{a_2\rho\cos\theta+b_2\rho\sin\theta}.$$

Transforming back to rectangular co-ordinates, we have

$$2(a_1x+b_1y)(a_2x+b_2y)+c_1(a_2x+b_2y)+c_2(a_1x+b_1y)=0$$

for the locus of P. This equation represents a hyperbola passing through the vertex A. Hence the intersection of this hyperbola with the base CB will give R, and PR produced will give T.

CALCULUS.

248. Proposed by REV. R. D. CARMICHAEL, Anniston, Ala.

Evaluate $\int_0^{\frac{1}{2}\pi}\sin nx\cot x\,dx$, where n is a positive integer.

II. Solution by FRANCIS RUST, C. E., Pittsburg, Pa.

$$\sin nx=n\cos^{n-1}x\sin x-\binom{n}{3}\cos^{n-3}x\sin^3x+\binom{n}{5}\cos^{n-5}x\sin^5x-\dots$$

$$\therefore\int_0^{\frac{1}{2}\pi}\sin nx\cot x\,dx=n\int_0^{\frac{1}{2}\pi}\cos^n x\,dx-\binom{n}{3}\int_0^{\frac{1}{2}\pi}\cos^{n-2}x\sin^2x\,dx$$

$$+\binom{n}{5}\int_0^{\frac{1}{2}\pi}\cos^{n-4}x\sin^4x\,dx\dots\pm\binom{n}{2r+1}\int_0^{\frac{1}{2}\pi}\cos^{n-2r}x\sin^{2r}x\,dx+\dots$$

Transforming $\int_0^{\frac{1}{2}\pi}\sin^pz\cos^qz\,dz$ by the substitution $\sin z=\sqrt{x}$, we have

$$dz=\frac{dx}{2\sqrt{[x(1-x)]}},\text{ and }\int_0^{\frac{1}{2}\pi}\sin^pz\cos^qz\,dz=\tfrac{1}{2}\int_0^1x^{\frac{1}{2}(p-1)}(1-x)^{\frac{1}{2}(q-1)}dx$$

$$=\tfrac{1}{2}B[\tfrac{1}{2}(p+1),\tfrac{1}{2}(q+1)].$$

$$\therefore\int_0^{\frac{1}{2}\pi}\sin nx\cot x\,dx,\text{ in beta-functions,}=\frac{n}{2}B\left(\frac{n+1}{2},\frac{1}{2}\right)$$

$$-\tfrac{1}{2}\binom{n}{3}B\left(\frac{n-1}{2},\frac{3}{2}\right)+\tfrac{1}{2}\binom{n}{5}B\left(\frac{n-3}{2},\frac{5}{2}\right)-\dots$$

Also solved by C. E. White.

250. Proposed by V. M. SPUNAR, East Pittsburg, Pa.

Differentiate $(\log^n x)$.